

The Evaluation of the Type & Calcification Patterns in Styloid Process: A Retrospective Digital Radiographic Study

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Abstract: Styloid process (SP) is a long, slender and pointed bony process projecting downwards, forwards and slightly medially from the temporal bone. It may vary in its length and thickness with the degree of ossification. SP elongation is known as Eagle's Syndrome when it causes clinical symptoms such as neck and cervicofacial pain. The study is to determine the incidence of type/patterns of calcification in SP and correlation between types and patterns of calcification of styloid process with age and gender. 120 digital panoramic radiographs were assessed retrospectively from the archives of Department of Oral Radiology for the length, type/patterns of calcification of styloid process within the age range of 21-60 years. The apparent length was measured with the help of measuring tools on the accompanying software. The type and pattern of SP was classified as per Langlais's classification. The data obtained is further subjected to statistical analysis. Among 120 subjects, there were 30 subjects in each age group which were equally divided into males and females with minimum age of 21 years and maximum of 60 years. The most common type & pattern in all the age groups was Type I & Type A of styloid process respectively. On comparison with male and female the most common type of styloid process is Type I and most frequent pattern is Type A. There is no statistical significance association of styloid process type and pattern between males and females & age groups. Digital panoramic radiography is useful for detection of an elongated SP or ossification of stylohyoid ligaments in patients with or without symptoms and can thus avoid misinterpretation of symptoms such as tonsillar pain or pain of dental, and pharyngeal region. Hence a radiographic classification of the styloid process may help to clarify the diagnosis and aid in surgical planning.

Keywords: Styloid process, Orthopantomograph

INTRODUCTION

The styloid process is a cylindrical bony growth, arises from the lower surface of the petrous temporal bone in front of stylomastoid foramen [1-3]. It is developed from the 2nd brachial arch a reichert's cartilage, because of the cartilaginous origin the ligament has the potential to mineralize [7]. The normal length of styloid process is 20-30mm and more than 30mm is considered as an elongated styloid process[5,6].

Styloid process lies caudally, medially and anteriorly toward the maxilla-vertebro pharyngeal recess (which contains carotid arteries, internal jugular vein, facial nerve, glossopharyngeal nerve, vagal nerve and hypoglossal nerve). Calcification/ossification of stylohyoid ligament can contribute to elongated styloid process, which in turn can lead to eagle's syndrome causing compression of neural and vascular structures in the retrostyloid compartment[7]. In 1652 Pietro

Marchetti Italian surgeon first described the syndrome. The term stylgia was coined by Eagle in 1937 to describe the pain associated with elongation of the styloid process [8]. The symptoms of elongated styloid process comprises of dull aching pain localized in either or both the sides of the throat and may be referred to the ear or mastoid region of the same side, Dysphagia or an abnormal sensation of foreign body in the pharynx[6,9]. Some uncommon symptoms the tinnitus or otalgia may occur[9]. These symptoms get confused with other diseases such as facial neuralgias, & Temporomandibular disorders[10].

However, studies have reported that elongated styloid process need not always produce symptoms resembling Eagle's syndrome. Hence, this study was done to assess the prevalence of type of elongation and pattern of calcification according to Langlais *et al.* As best of our knowledge no similar studies were found.

Aims and objectives

- To determine the incidence of type/patterns of calcification in SP
- Correlation between types and patterns of calcification of SP with age and gender

MATERIALS AND METHODS

- The study consisted of 120 digital panoramic radiographic images of patients selected from the archival records of Oral Radiology Department with age range of 21-60 years. These radiographs were obtained from Kodak 8000C panoramic system with exposure parameters of 75kvp, 12ma and 12s as recommended by the manufacturer. All the measurements were done using Master View 4.5.1 version software.
- The study sample was divided into 4 age groups of 30 each with sex matched equal

distribution that is Group 1(21-30), Group 2(31-40), Group 3(41-50), & Group 4(51-60). Panoramic radiographs in which SP was clearly evident were included in the study to evaluate the type and pattern of calcification of SP. The apparent length of SP on both sides were measured from caudal margin of tympanic plate to tip of SP & considered as elongated if it was measuring more than 30mm. Type & patterns of calcification of SP were measured as per Langlais' classification (Fig 1 & Fig 2)[11]. The types & calcification pattern of styloid process seen and the measurements of styloid process done in our study are shown in (Fig 3, Fig 4 & Fig 5) the results were analysed by software version SPSS 16.0 using chi square test.

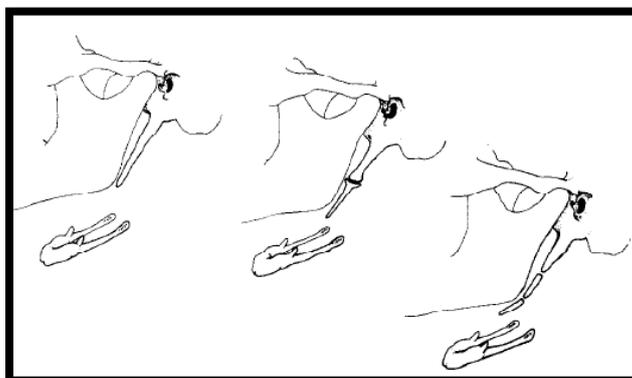


Fig-1: Types of styloid process from left to right: Type I (elongated), Type II (pseudoarticulated), and Type III (segmented).

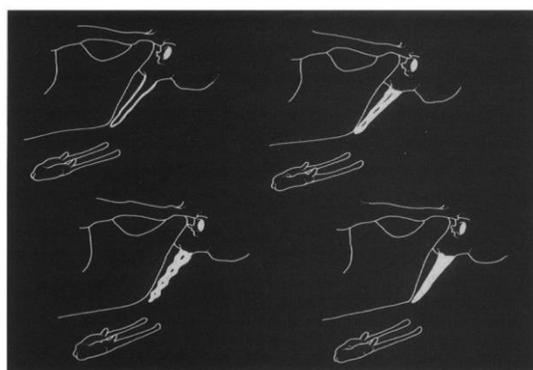


Fig-2: Pattern of calcification: Upper left, calcified outline; upper right, partially calcified; lower left, nodular; lower right, completely calcified.

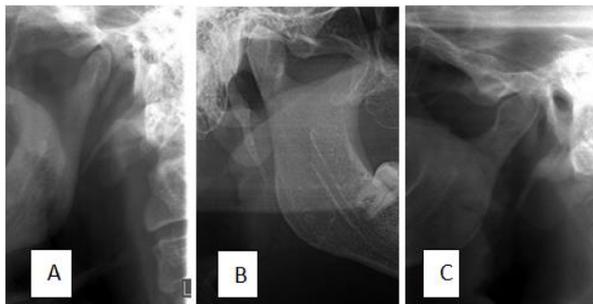


Fig-3: A(Type I) B(Type II) C(Type III)



Fig-4: Pattern of calcification: A Calcified outline (Type A), B Partially calcified (TypeB), C Nodular(Type C), D Completely calcified (Type D)

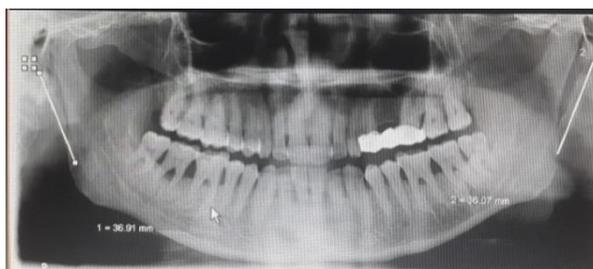


Fig-5: Represents the measurements of styloid process in digital radiography using measuring tools.

RESULTS

Among 120 subjects, there were 30 subjects in each age group which are equally divided into males and females with minimum age of 21 years and maximum of 60 and the mean age among male and female was 40.75 ± 12.20 & 41.43 ± 12.36 respectively. There is no statistically significant difference of age among male and female subjects i.e., ($z = 0.14$, $p > 0.05$) [table 1].

The most common type in all the age groups was Type I of styloid process followed by Type III and

Type II with both right and left side of the styloid process[table 2]. most frequent pattern in all the age groups of styloid process was Type A followed by Type B, Type D & Type C[table 3]. There is no statistical significance difference of styloid process Type and Pattern between the age groups.

On comparison with male and female the most common type of styloid process is Type I [table 4] and most frequent pattern is Type A [table 5]. There is no statistical significance association of styloid process type and pattern between males and females.

Table -1: Age and sex wise distribution of cases

AGE	MALE		FEMALE		TOTAL	
	NO.	%	NO.	%	NO.	%
21-30	15	25.0	15	25.0	30	25.0
31-40	15	25.0	15	25.0	30	25.0
41-50	15	25.0	15	25.0	30	25.0
51-60	15	25.0	15	25.0	30	25.0
TOTAL	60	100.0	60	100.0	120	100.0
MEAN \pm SD	40.75 ± 12.20		41.43 ± 12.36		41.09 ± 12.23	

$z=0.14$ $p>0.05$ not significant there is no statistically significance difference of age among males and females

Table-2: Age wise comparison of type of styloid process

AGE	NO.OF CASES	TYPE I		TYPE II		TYPE III	
		RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT
21-30	29	12	7	1	2	3	4
31-40	19	9	5	0	2	1	2
41-50	26	9	7	3	3	2	2
51-60	23	7	6	2	2	2	4

* The remaining subjects in each age groups where not holding any of the types according to Langland classification.

Table - 3: Age wise comparison of pattern of styloid process

AGE	NO.CASES	RIGHT				LEFT			
		A	B	C	D	A	B	C	D
21-30	30	15	10	0	5	14	6	3	7
31-40	30	19	6	1	4	10	13	1	6
41-50	30	18	11	1	0	13	14	2	1
51-60	30	12	14	1	3	13	12	1	4
TOTAL	120	64	41	3	12	50	45	7	18
	(100.0)	(53.3%)	(34.2%)	(2.5%)	(10.0%)	(41.7%)	(37.5%)	(5.8%)	(15.0%)

$\chi^2=2.670$ $p>0.05$ Not significant

There is no statistical significance difference of styloid process Type and Pattern between the age groups.

Table -4: Sex wise comparison of type of styloid process

SEX	TYPE I		TYPE II		TYPE III		TOTAL
	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	
MALE	21	12	3	5	7	8	56
FEMALE	16	13	3	4	1	4	41
TOTAL	37	25	6	9	8	12	97

* The remaining subjects in each age groups where not holding any of the types according to Langland classification.

Table-5: Sex wise comparison of pattern of styloid process

AGE	RIGHT				LEFT				TOTAL
	A	B	C	D	A	B	C	D	
MALE	30	21	2	5	27	21	2	9	120
FEMALE	34	20	1	7	23	24	5	9	120
TOTAL	64	41	3	12	50	45	7	18	240

$\chi^2=5.10$ $P<0.05$ significant

There is statistical significance association of styloid process between left and right in females

$\chi^2=2.89$ $P>0.05$ Not significant

There is no statistical significance association of styloid process between left and right in males

$\chi^2=3.05$ $P>0.05$ Not significant

There is no statistical significance association of styloid process type and pattern between males and females

DISCUSSION

The term “styloid process” is derived from the Greek word ‘Stylos’ meaning a pillar. It is normally a cylindrical bone which arises from the temporal bone in front of the stylomastoid foramen. Stylopharyngeous, Stylohyoid and Styloglossus muscles and Stylohyoid and Stylomandibular ligaments are the structures which are attached to it [1]. The complete stylohyoid apparatus is developed from 4 segments that are Tympanohyal portion, Stylohyal portion, Ceratohyal portion , Hypohyal portion [5].

Anatomical dissimilarity in the length of the styloid process and its stylohyoid chain is of profound

anatomical, anthropological as well as clinical importance [5]. To describe its radiographic appearance it is necessary for defining the type of elongation and calcification of each styloid process [5]. As it has various variations in styloid chain, along with the thickness of segments, angle and direction of deviation, length of process and degree of calcification [12,5]. Hence in order to simplify the description, Langlais *et al.* had classified styloid process based on the type of elongation and calcification[8].

An awareness of clinical and radiologic presentation of styloid process elongation is important to all health practitioners involved in the diagnosis and treatment of head and neck pain. Eagle syndrome,

sometimes called styloid or stylohyoid syndrome, is defined as the symptomatic elongation of the styloid process or mineralization (ossification or calcification) of the stylohyoid ligament complex [10]. It was first documented in 1937 by Eagle, an otorhinolaryngologist [13]. The mechanism of ossification of these parts is not fully understood. It is suggested that the stylohyoid ligament retains some part of cartilage within during ossification which resulted in varying degrees of ossification and elongation of stylohyoid chain [5]. It could be considered as an important contribution toward an increase in the length of the stylohyoid complex [10].

The several theories have been proposed such as reactive metaplasia, reactive hyperplasia, anatomic variance, ageing, developmental anomaly [10], and trauma leading to loss of elasticity in the ligament simulating tendinosis [13]. Can also be due to growth of osseous tissue at the insertion of stylohyoid ligament, calcification of stylohyoid ligament, is unknown process or persistence of cartilaginous analog of stylohyal ligament [8]. The calcification of the styloid is now considered to be a part of heterotopic bone formation or ossification [13].

Our study mainly emphasized on the effect of age and sex on length, elongation and calcification patterns of styloid process. Among 4 age groups with an equal division of 30 samples the type I SP was most commonly found in group 1 followed by group 3, 2 & 4 that is 29, 26, 23 & 19 respectively. The results of our study showed a high incidence of Type 1 styloid process among all the age groups followed by Type 3 and Type 2 SP (table 2) the remaining samples were not holding any of the classification according to Langland. These results are in accordance with Kashyap *et al.*, and Ilguy *et al.* [10,6] According to a study by Gupta *et al.* Type 1 SP was more in 26-33 years of age which is in approximation with our study group where Type 1 is more predominant in 21-30 years.

The present study also showed a high incidence of Type a pattern of calcification of styloid process among all the age groups followed by Type B, Type D, & Type C. (Table 3). These results were similar to Shah *et al.* & Shaik *et al.* [9,8] Among all the groups Type A is more predominant in 41-50 years. The study showed Type 1 styloid process more common amongst males than females that is 33 & 29 respectively which is concordance (Table 4) the remaining samples were not holding any of the classification according to Langland with Sudakar reddy *et al.*, & Gupta N *et al.* [5,1]. The study showed most common Type a pattern of calcification among male and females (Table 5). Altogether our study revealed that there is no statistical significance difference of styloid process type and pattern between the age groups & gender wise.

Styloid process is frequently misdiagnosed and are often treated by family physicians, otolaryngologists, neurologists, neurosurgeons, dentists, maxillofacial surgeons and psychiatrists with little success [6] so to improve the diagnostic aspect of the styloid process diseases there are advanced imaging modalities available as computed tomography [6] & cone beam computed tomography. Hence further studies with larger sample size should be considered to evaluate the styloid process.

CONCLUSION

Digital panoramic radiography is useful for detection of an elongated SP or ossification of stylohyoid ligaments in patients with or without symptoms and can thus avoid misinterpretation of symptoms such as tonsillar pain or pain of dental, and pharyngeal region. However, the clinical importance of different morphological patterns has not been clearly understood so far. Hence a radiographic classification of the styloid process may help to clarify the diagnosis and aid in surgical planning

REFERENCES

1. Gupta N, Khan M, Doddamani LG, Kampasi N, Ohri N. A study on assessment of the length of styloid process in digital panoramic radiographs. *J Indian Acad Oral Med Radiol* 2015;27:516-9.
2. Chourdia V. Elongated styloid process (Eagle's syndrome) & severe headache. *Indian J Otolaryngol Head Neck Surg* 2002;54:238-41.
3. Monsour PA, Young WG. Variability of the styloid process and stylohyoid ligament in panoramic radiographs. *Oral Surg Oral Med Oral Pathol* 1986;61:522-6.
4. Shete M, Khalekar Y, Byakodi R. Evaluation of styloid process using digital panoramic radiographs. *SRM J Res Dent Sci* 2015;6:215-9.
5. Sudhakar Reddy R, Sai Kiran Ch, Sai Madhavi N, Raghavendra MN, Satish A. Prevalence of elongation and calcification patterns of elongated styloid process in south india. *J Clin Exp Dent*. 2013;5(1):e30-5.
6. Ilgüy M, Ilgüy D, Güler N, Bayirli G. Incidence of the type and calcification patterns in patients with elongated styloid process. *J Int Med Res* 2005;33:96-102.
7. Raviraj J, Satish G, Divya KT, Reddy V, Shetty SB. Length, types and patterns of calcification of stylohyoid complex: A retrospective radiographic study. *J Int Oral Health* 2015;7(11):67-70.
8. Shaik MA, Naheeda, Kaleem SM, Wahab A, Hameed S. Prevalence of elongated styloid process in Saudi population of Aseer region. *Eur J Dent* 2013;7:449-54.
9. Shah SP, Praveen NB, Syed V, Subhashini AR. Elongated styloid process: A retrospective panoramic radiographic study. *World J Dent* 2012;3:316-9.

10. Kashyap RR, Kashyap RS, Naik V, Kini R. The styloid process: Morphological variations in South Indian population. *Indian J Otol* 2015;21:25-8.
11. Langlais RP, Miles DA, Van Dis ML. Elongated and mineralized stylohyoid ligament complex: A proposed classification and report of a case of Eagle's syndrome. *Oral Surg Oral Med Oral Pathol* 1986;61:527-32.
12. More CB, Asrani MK. Evaluation of the styloid process on digital panoramic radiographs. *Indian J Radiol Imaging* 2010;20:261-5.
13. Bagga MB, Kumar CA, Yeluri G. Clinicoradiologic evaluation of styloid process calcification. *Imaging Sci Dent* 2012;42:155-61.